The graph of the temperature gradient is given and compared with Ferrel's graph. A density graph computed from the pressure and temperature graphs is also given and compared with Cottier's density graph computed from the formula $\frac{p_0}{p_1} = \left(\frac{\rho_0}{\rho_1}\right)^v$ where v has the experimental value 1.2.

Attention is also called to the need of more accurate and systematic data for the determination of the temperature gradient at altitudes from 5,000 to 20,000 meters.

John Zeleny,
Secretary.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION G, BOTANY.

The Section met for organization on Monday, August 26, at 11.30 a. m., with the Vice-President, Mr. B. T. Galloway, in the chair. The following were the officers for the Denver meeting:

Vice-President, B. T. Galloway.
Secretary, E. A. Bessey (in absence of A. S. Hitchcock).
Sectional Committee, Wm. Trelease, Vice-President 1900; D. T. MacDougal, Secretary 1900; B. T. Galloway, Vice-President 1901; E. A. Bessey, Secretary 1901; C. E. Bessey, C. L. Shear, Miss C. E. Cummings.
Member of General Committee, W. J. Beal.
Member of Council, D. H. Campbell and L. M. Underwood.*

On Wednesday, August 28, in accordance with the custom established at the last New York meeting, Section G held a joint session with the Botanical Society of America, the officers of the latter taking charge of the meeting.

On Thursday evening the following were chosen by the General Committee as Vice-President and Secretary, respectively, for the Pittsburg meeting, June, 1902: D. H. Campbell, Leland Stanford University, and Hermann von Schrenk, Shaw School of Botany.

*Chosen to succeed D. H. Campbell after the latter's early departure.

The following is a complete list of the papers presented. Abstracts are given where furnished by the authors, except for the papers presented at the joint meeting with the Botanical Society of America, abstracts of which will be published elsewhere by the Secretary of that Society.

1. 'Thermal Relations of Plants': D. T. MacDougal. (No abstract furnished.)

2. 'Experiments with Lime and Solutions of Formaldehyde in the Prevention of Onion Smut': A. D. Selby.

Onion Smut, *Urocystis cepulæ* Frost, a soil-infesting fungus, has become introduced into soils devoted to the growing of onion sets near Chillicothe, Ohio, and into those devoted to the growing of market onions about Berea, Ohio. Certain results of experiments made in 1900 at Chillicothe were published in a bulletin (No. 122) of the Ohio Experiment Station. These showed decided advantages of quicklime applied to the soil before seeding and of dilute solutions of formaldehyde in water sprinkled upon the seeds in contact with the soil, as compared with flowers of sulphur, sulphur and lime (in small quantities), and other substances heretofore proposed for the prevention of onion smut. More extended experiments along these lines were conducted both at Chillicothe and Berea during 1901. The results from Chillicothe are now at hand and show very gratifying smut prevention and corresponding increase in the yield of onion sets. All plots herein considered are 760 square feet in area; results are stated in actual and calculated yields.

Plot.	Treatment.	Actual yield, lbs. per plot.	Calculated yield per acre, bushels.
I.	Lime, 34 bu. per A.	121.6	174.
II.	" 70 " " "	152.0	217.5
III.	Formalin, .375% sol.	196.0	280.8
IV.	Nothing	92. (large sets)	131.8
V.	Formalin, .75% sol.	202.	289.4
VI.	Lime, 125 bu. per A.	203.	290.8
VII.	" 70 " " " and Formalin, .375% sol.	214.	306.5

Thus lime, at the rate of 70 bushels per acre, gave an increase in yield of 65 per cent. over the untreated plot. Formalin, .375 per cent. solution, an increase of 113 per cent. and double that strength an increase of 119.6 per cent. Seventy bushels of lime per acre and the weaker solution of formalin combined gave an increase of 132.5 per cent., while lime at the rate of 125 bushels per acre gave an increase of 120.5 per cent. The lime used was purchased in the ground state and was applied with a drill before the hoes, chiefly on the surface. The formaldehyde solutions were applied by trickling down with the seeds. This paper will be printed in a bulletin of the Ohio Agricultural Experiment Station.

3. 'Comparative Climate of a Meadow and Hemlock Forest': D. T. MACDOUGAL. (No abstract furnished.)

4. 'The Tylostomaceæ of North America': V. S. WHITE, presented by L. M. Underwood.

The extensive accumulation of material bearing on the stalked puffballs in the Ellis collection, supplemented by considerable material sent in from the Southwest by Professors Wooton, Cockerell and Griffiths has led to a complete revision of the species of this family, which is now appearing in the August number of the *Bulletin of the Torrey Botanical Club*. This is illustrated by ten plates (exhibited when the paper was read). A summary of the results is as follows:

The family as represented in North America consists of—

Tylostoma—Seventeen species, of which eight are new. Of these seventeen species eight are found in Colorado, which is double the number from any other State with the single exception of Kansas, which has five species. Of the eight new species four are from Colorado.

Chlamydopus—One species recently collected in New Mexico by Professor Cockerell. The genus has hitherto been known only from South America.

Battarrea—Four species of which two are new. All from the Southwest.

Queletia—One species, possibly introduced from Europe. Found once in this country.

Dictyocephalos—A new genus from Colorado, collected by Professor Bethel, of Denver; monotypic.

Much still remains to be known of the early stages of these plants; in fact very little is known of them. Much also remains to be known of their geographic and seasonal distribution. Two-thirds of the family belong to the region of the Great Plains southwestward to Texas, Sonora and southern California.

5. 'Lantern Views of the Botanical Garden of the Agricultural College of Michigan': W. J. BEAL.

The author exhibited views showing the arrangement of the garden and gave many practical hints concerning the management of botanical gardens.

6. 'Plants of the Eastern Foothills': FRANCIS RAMALEY.

The author exhibited a number of views showing some of the more characteristic plants of the eastern foothills of the Rocky Mountains in Colorado.

7. 'Some Protective Leaf Movements induced by Winter Temperature': WM. TRELEASE.

The paper records, with lantern illustrations, observations upon the drooping and inrolling of *Rhododendron* leaves and the inrolling of leaves of *Yucca flaccida*, effected when the freezing temperature is reached, by which protection is secured against undue radiation and evaporation. Reference is made to Harshberger's paper of 1889, and Darwin and Acton's and MacDougal's text-books of plant physiology which thus far appear to refer only to *Prunus laurocerasus* and the gener named.

8. 'Germination of Seeds of some Common Cultivated Plants after prolonged Immersion in Liquid Air': A. D. Selby.

At the suggestion of Mr. J. E. Woodland, of Wooster, Ohio, who was conducting experiments with liquid air during the winter season of 1900–1901, the writer prepared and supplied him with seeds of *Ricinus*, *Lupinus luteus*, maize, flax, wheat, rye, cucumber, Russian sunflower, *Pinus sylvestris*, *Mimosa pudica*, *Onobrychis sativus*, *Chenopodium album* and *Pinus parryana*. At first the lots of seed were immersed in the liquid air directly from the room temperature and kept submerged for six and twelve hours, respectively. Later other lots were given a gradual transition from the temperature of the room to that of the liquid air and an equally gradual withdrawal, being immersed for twenty-four and forty-eight hours, respectively. The seeds were then germinated in the usual manner, together with control lots reserved when the original packages were selected. There was practically no essential effect of the treatment noticeable upon the percentages of seeds that germinated, the control, short treated, and longer treated lots giving essentially the same percentages of germination. This paper will be printed in the *Bulletin of the Torrey Botanical Club*.

On Wednesday the following program was given in joint session of Section G and the Botanical Society of America:

Address of the Retiring President—'Problems and Possibilities of Systematic Botany': B. L. Robinson. Read by J. M. Coulter.

'The Fundamental Phenomena of Vegetation': F. E. Clements.

'Early Winter Colors of Plant Formations upon the Great Plains': C. E. Bessey.

'The Plant Formations of the Rocky Mountains' (lantern lecture): F. E. Clements.

'A Suggested Hybrid Origin of *Yucca gloriosa*' (lantern lecture): Wm. Trelease.

'The Physical Basis of Ecology': F. E. Clements. (By title only.)

'The Anatomy of the Embryo and Seedling of *Tsuga canadensis* Carr' (by invitation): W. A. Murrill. Read by J. M. Coulter.

'Clues to Relationship among Heteroecious Plant Rusts': J. C. Arthur. Read by L. M. Underwood.

'Some of the Changes now taking place in a Forest of Oak Openings': W. J. Beal.

'Preliminary Notes on the Flora of Western Iowa, especially from the Physiographical-Ecological Standpoint': L. H. Pammel. (By title only.)

'The Life History of *Vittaria lineata*': E. G. Britton and A. Taylor. Read by L. M. Underwood.

'A System of Nomenclature for Phytogeography': F. E. Clements.

'The Application of Ecology in Taxonomy': F. E. Clements. (By title only.)

On Thursday the regular session of Section G was resumed with the following papers:

9. 'The Location of a Tropical Research Station in Porto Rico': L. M. Underwood.

The agricultural station in Porto Rico should, if possible, be located where it will also be available as a station for general botanical research. A combination of (1) the greatest amount of agricultural production, not alone in coffee, sugar and tobacco, but also in the minor products; (2) the greatest accessibility from all portions of the island, and particularly those portions where the most important agricultural products are cultivated under most favorable conditions; and (3) the most interesting botanical portion of the island, including accessibility to a large original forest, is met with in the eastern half of the island and particularly in the region between Arecibo and Utnado. With this can be com-

bined many less prominent but important accessories, particularly access to an abundant supply of potable water.

10. 'Notes on Colors of Salsify Hybrids': BYRON D. HALSTEAD.

Hybrids between *Tragopogon porrifolius* L. (garden salsify) and the wild species, *T. pratensis* L., were reported on last year. The following paper considers only the color side of the results obtained with hybrid seedlings the present year (second generation hybrids). According to the standard color chart employed (Prang's), the cultivated salsify has for the color of its corollas a mixture of violet and red, corresponding to No. 224 (VRV/L), *i. e.*, light violet red violet—a shade of purple, in ordinary language. The other parent has a plain yellow. The direct hybrid of these two is of two distinct types, the one with the color uniform throughout the head, and the other, about equally numerous, with a yellow in the center, although here the tips of all the corollas are of the same color as the ray blossoms, namely No. 241 (RRV/DD), *i. e.*, darker red red violet. It is seen by this that the *T. porrifolius* controls the color, although the violet of this parent gives place largely to red. The crossing is reciprocal and the results are the same whichever is the seed parent. Among the hundreds of seedlings grown this season no less than 36 numbers upon the color chart are represented. Out of 200 counts the following is the record for the 13 having the largest score: Yellow, 10; light yellow, 12; lighter yellow, 6; darker orange red orange, 9; darker red orange, 6; darker red, 23; dark red, 13; light red violet, 9; lighter red violet, 7; violet red violet, 23; light violet red violet, 35; lighter violet red violet, 29; dark violet gray, 6. It is seen that in the second generation the colors are many. Both parents are now represented, and many intergrades between their respective colors. The yellows in all the tints score 28 points to 103 by the violet reds. If all the shades obtained were enumerated under their appropriate heads the violet reds would outnumber the yellows by 41. There were no pure orange blossoms, but in combination with red there were many representatives. The yellow failed to blend with any other color. In one instance there was a plant with slate-colored blossoms, thus bringing in the blue of the chromatic scale, and several specimens had a strong tendency towards chlorosis, thus completing the series in the solar spectrum. A chart of the prismatic colors, violet, blue, green, orange, yellow and red was constructed, and the parent hybrid and its seedlings located with pasters of colored paper, while the relative amount of each of the latter was shown by the size of the paper bearing the color corresponding to that of the seedling hybrid flowers thus graphically represented. It is thus evident that with the salsify hybrid, while there is uniformity the first year, it is otherwise the second season, with a tendency to revert to the parent types. The red, present in obscure form in one parent only, becomes very prominent the first year and yields many unmixed reds the second. Out of this union by selection it is probable that many strongly contrasting types might be fixed.

11. 'Observations on *Egregia menziesii*': FRANCIS RAMALEY.

Egregia consists, as do the other Laminariaceæ, of hold-fast, stipe and lamina; the branching of the stipe gives rise to members (branches) each having the characters of the entire frond of *Alaria*. The multiform proliferations which occur on both stipe and lamina replace functionally the large lamina in other genera. This structure is, in *Egregia*, greatly reduced in size and importance. On account of the great elongation of the stipe a floating ap-

paratus has become necessary, and this is provided in the vesicles developed by the swelling of the stalks of certain proliferations. The presence of vesicles gives *Egregia* a superficial resemblance to *Macrocystis*, while it is probably more nearly allied to *Alaria*. A mathematical study of variation in *Egregia menziesii* leads to the conclusion that the species is in a state of equilibrium. The curves of variation are all symmetrical and remarkably similar. *Egregia* presents some interesting anatomical features which cannot be well summarized. This paper will be printed in *Minnesota Botanical Studies*.

12. 'The Morphology of the Pine Cone': C. E. Bessey.

Although there has been much discussion of the morphology of the 'ovuliferous scale' of the pine cone, recent summaries show that it is not yet satisfactorily settled. The author suggests an explanation which he has used in his lectures to students in the University of Nebraska for several years. Comparing the cones of Cupressineæ, Taxodieæ, Araucarieæ and Abietineæ, they are found to be alike, with a similar origin for their ovules, but in the Abietineæ there is in connection with each ovule a woody scale, while in Araucarieæ there is a rudimentary scale. This scale is regarded as a backward development of the ovule, and the cones are therefore strictly homologous. Concisely stated, this view may be formulated as follows: The microsporangial and megasporangial cones are strictly homologous, and in the latter the sporophyll enlarges or remains small, just as a chalazal development of the megasporangium into a scale is less or more pronounced. According to this view the Abietineæ must be given place at the summit of the Conifers. This paper will be printed in Science.

13. 'General Botanical Features of the Coast Mountains of California': Alice Eastwood.

The Coast Mountains of California extend from the northern to the southern part of the State, passing through about ten degrees of latitude, and rise from the sea level to an altitude of more than 9,000 feet. Consisting of many different chains and spurs, with valleys between made up of different geological formations, a great variety characterizes their flora. Many genera are in an unsettled condition and the species are uncertain. The outer ranges may be divided into four environmental zones: (1) That along the sea coast, characterized by fleshy plants or those clothed with some form of pubescence. They do not differ much from maritime plants in other regions. (2) The forest areas, along streams where the redwoods (*Sequoia sempervirens*) find a home. This keeps quite close within the area of summer fog, and the plants are dependent upon moisture and shade. (3) The grassy uplands and valleys. Here, during the rainy season, flowers (mostly annuals) grow in great profusion and form beautiful gardens. They soon disappear and the hills become yellow, except where clumps of oaks, pines, or spruces occur. (4) The brush-covered hills, where the shrubs grow so close together that it is almost impossible to travel through them except on the trails. They hold the water by their roots and prevent evaporation by their dense growth. Most of them show characteristics belonging to desert plants rendered necessary by the long drought and the intense heat to which they are subjected in the summer. The southern coast mountains become even more desert-like in the character of their flora, and here and there will be found wanderers from the desert. The northern coast mountains in general rise to a greater elevation, and in some of the chains the character of the mountains is like that of the Sierra Nevada range and the flora similar at like elevations. A great amount of work has to be

done before many of the genera are understood and a great deal of territory must be explored before the species are approximately known. Following this work, the problems of geographical distribution can be solved and life zones satisfactorily mapped out.

14. 'The Xerophytic Vegetation of the Uintah Mountains': L. H. PAMMEL.

In the Uintah range occur types of plants from the arid regions of the Southwest, boreal types in the mountains farther northward, and many forms from the main Rocky Mountain flora. The largest xerophytic areas occur in the Colorado and Green River basins. The xerophytic vegetation of the Uintah range varies with the different physiographic conditions and geologic formations. One naturally expects to find a very different flora in passing through the Green River and lower basins up to the higher peaks such as Gilbert, La Motte and Wilson; however, at an altitude of 9,200 feet the valleys and park-like openings have many xerophytic plants common to the lower basins of the streams. The succession of plant formation in this region is fairly well marked; it is not difficult, therefore, to trace a succession of plant life on the flood plains since the quaternary. The foothill and mountain floras change successively from hydrophytic to mesophytic, then to xerophytic and finally culminate in the mesophytic of the foothills with hydrophytic basins. In the Green River basin and the tributaries of the immediate vicinity of this basin the xerophytic plants are much more pronounced than in the foothills. In the broad flood plains of Green River there occur such plants as *Distichlis spicata*, the widely distributed *Hordeum jubatum*, and the western *H. cæspitosum*. The habit of growth and the manner of reproduction of *Distichlis* make it well adapted to the conditions prevailing in that arid region. Two Capparidaceous plants, *Cleome integrifolia* and *C. lutea*, are common. A somewhat similar yellow-flowered crucifer, *Stanleya pinnatifida*, is scattered through the dry lowlands. Naturally one expects to find many chenopodiaceous plants. Their succulent leaves enable them to adapt themselves to these dry regions. *Sarcobatus vermiculatus*, *Chenopodium fremontii*, *C. rubrum*, *Eurotia lanata* and *Suæda depressa* are common plants of the dry basins. *Artemisia tridentata* with its accompanying *Eriogonum ovalifolium* and *E. umbellatum* are common at higher altitudes along Black's Fork. The terrace formation is especially well marked from the mouth of Black's Fork up to 8,500 feet. In the lower region there are small groves of *Juniperus occidentalis* var. *monosperma*, frequently accompanied by *Picea pungens*, *Juniperus communis* and *Arctostaphylos*. At an altitude of 7,500 feet three well-defined flood plains are recognizable. The present flood plain contains mesophytic groves, the second flood plain is dotted with small patches of trees and sage brush, the third flood plain contains no trees. *Artemisia tridentata* is the most characteristic plant. *Symphoricarpos*, *Lupinus* and *Stipa* also occur. From the third flood plain there is an abrupt rise of from three to five hundred feet. The sides are lined with *Symphoricarpos*, *Prunus*, and some sage brush. The top of the benches contains almost no trees except farther up, but sage brush, *Eurotia lanata*, *Stipa*, *Castilleia*, *Orthocarpus* and *Eriogonum* are characteristic plants.

15. 'Some Aspects of the Wyoming Desert Flora': AVEN NELSON.

South central Wyoming contains an extensive area known as the Red Desert. This has a considerable flora, the most obvious members of which belong in the genera *Artemisia*, *Atriplex*, *Chrysothamnus*, *Tetradymia*, *Sarcobatus*, and *Agropyron*. Besides this there is a very considerable fugacious vegetation. This desert flora,

while a limited one, is highly organized. It is succulent and rich in water by reason of its many contrivances for husbanding all its resources. Consolidation tends to reduce expenditure. Pleiocyclic herbs successfully maintain themselves by reason of their highly developed underground organs. The prevailing color of the flowers is yellow. Some of the vegetation is exceedingly tolerant of alkali, raising the question whether this property is due to histological peculiarities or represents a physiological difference in the protoplasm.

16. 'Effects of Salt Solutions on Seeds and Plants': E. E. Slosson.

Experiments have been carried on for several years on the action of the salts occurring in the soil of arid regions, as alkali, on the germination of seeds and the growth of plants. Solutions of sodium chloride, sulphate and carbonate; potassium sulphate and chloride; magnesium sulphate; and sugar; in solutions ranging in strength from 0 to 100 atmospheres osmotic pressure had been tested, the following seeds being used: corn, wheat, sunflower, peas, buckwheat, rape, beans, alfalfa, rye, clover, *Scirpus paludosus* and, for comparison, wood. It has been found that the imbibition of water is less from all solutions than from pure water. Solutions of all salts and of sugar of the same osmotic pressure retard and lessen the imbibition of water by seeds to about the same extent. Isosmotic solutions produce nearly the same effect in retarding the germination of seeds. Solutions of slight osmotic pressure stimulate germination. The same results are obtained with growing plants. Plants and seeds absorb a greater amount of potassium than of sodium salts from solutions of the same osmotic pressure, and more sulphates than chlorides. Hydroxyl ions increase the absorption of salts and of water by seeds. This paper will be printed in Bulletins of the Wyoming Experiment Station.

17. 'The Position of Protococcus and Mosses on Trees': Henry Kraemer. (Read by title.)

18. 'Contributions to the Knowledge of the Physiology of Karyokinesis': A. C. Lewis. (Read by title.)

This paper will be published in the *Botanical Gazette.*

19. 'Seedlings of *Arisæma dracontium*': Rosina J. Rennert. (Read by title.)

20. 'Some Plant Adaptations on the Tucson Plains': J. W. Toumey. (Read by title.)

Ernst A. Bessey,
Secretary, Section G.

MEMBERSHIP OF THE AMERICAN ASSOCIATION.

The following have completed their membership in the American Association for the Advancement of Science during the month of September.

Edward G. Acheson, President International Acheson Graphite Co., Niagara Falls, N. Y.

Curtis Alexander, Mining Engineer and Metallurgist, Spearfish, S. D.

J. Hartley Anderson, M.D., Physician, 4630 Fifth avenue, Pittsburg, Pa.

Bion J. Arnold, 4128 Prairie avenue, Chicago, Ill.

Andrew J. Bigney, Professor of Biology and Geology, Moores Hill College, Moores Hill, Ind.

R. I. Bond, M.D., Physician, Hartshorne, Ind. Ter.

Edwin D. Carnaghan, Mechanical Engineer, Durango, Do, Mexico.

Willard Colfax Cheney, Electrical Engineer, Portland, Ore.

Francis A. Crandall, 2219 15th street, N.W., Washington, D. C.

Col. William Crozier, U. S. A. Ordnance Office, Washington, D. C.

Dr. Kary Cadmus Davis, Professor of Horticulture and Forestry, W. Virginia State University, 628 N. High street, Morgantown, W. Va.

Wm. S. Hall, Professor of Mining and Graphics, Lafayette College, Easton, Pa.

John Hays Hammond, Mining Engineer and Geologist, Denver, Colorado.

Dr. Felix B. Herzog, Electrical Engineer, 51 West 24th street, New York, N. Y.

Julius Hortvet, State Chemist, 1521 University avenue S.E., Minneapolis, Minn.